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(54) Aerosol valve with improved vapor mixing

(57) An airosol valve especially suited for use with containers the products of which are pressurised by hydrocarbon propellants, has a homogenizer located close to the terminal orifice and consisting of many narrow passages such as a porous body 6 of open cell foam plastics material or a multiplicity of micronized grooves in a portion of the valve structure for thorough mixing of product and propellant vapor. This is particularly suitable for use with hydrocarbon propellants which are not compatible with the product to be sprayed. The mixing is so improved.

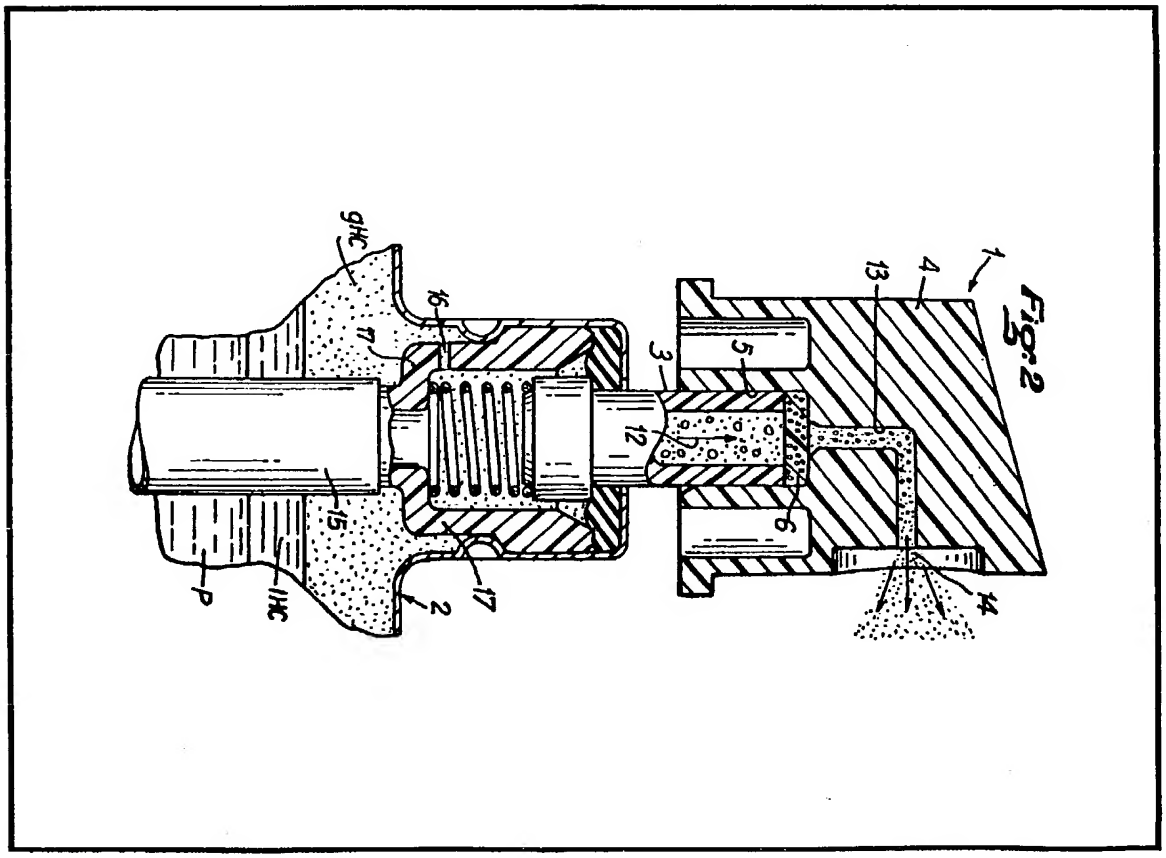

Fig. 2

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Fig:1

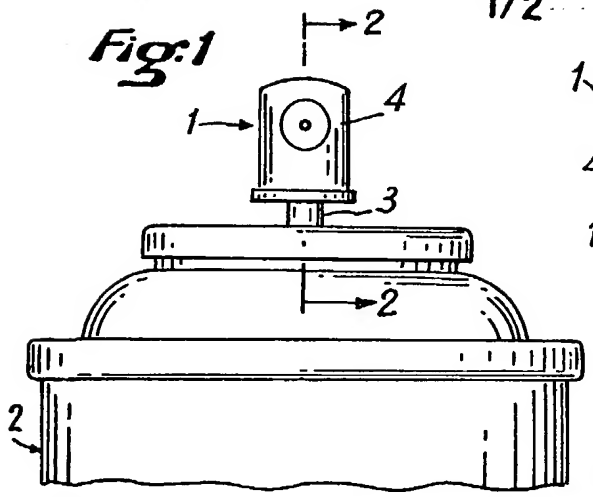


Fig:2

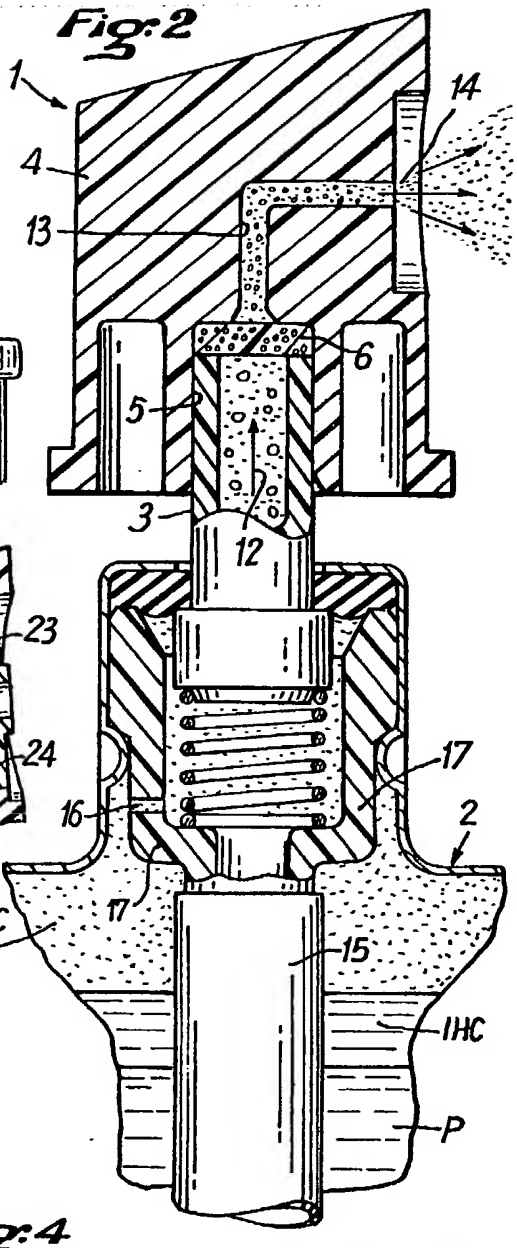


Fig:7

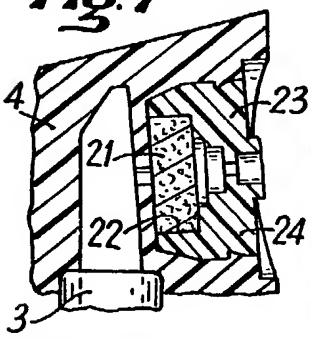


Fig:8

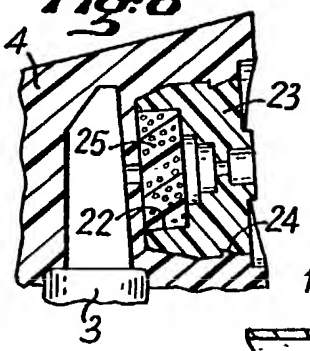


Fig:3

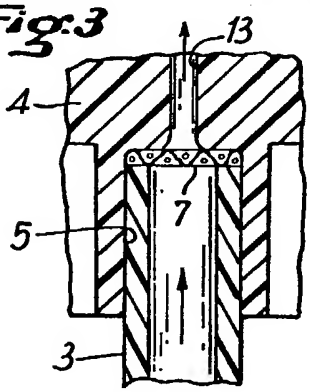


Fig:4

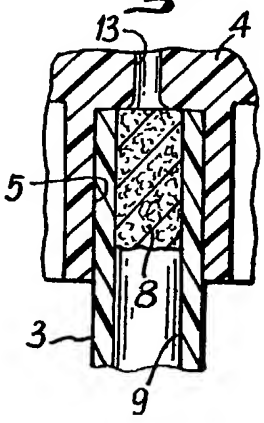


Fig:5

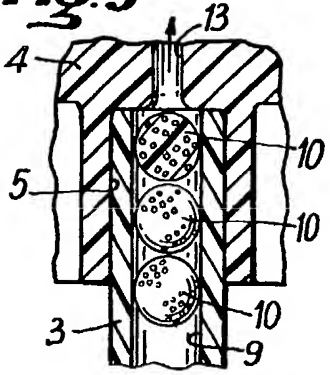


Fig:6

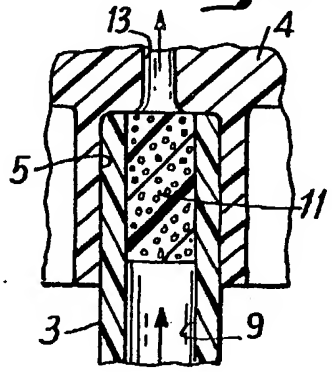


Fig:9

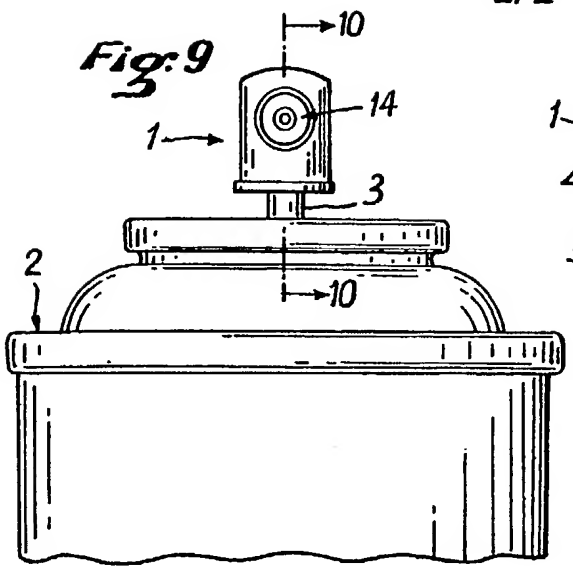


Fig:10

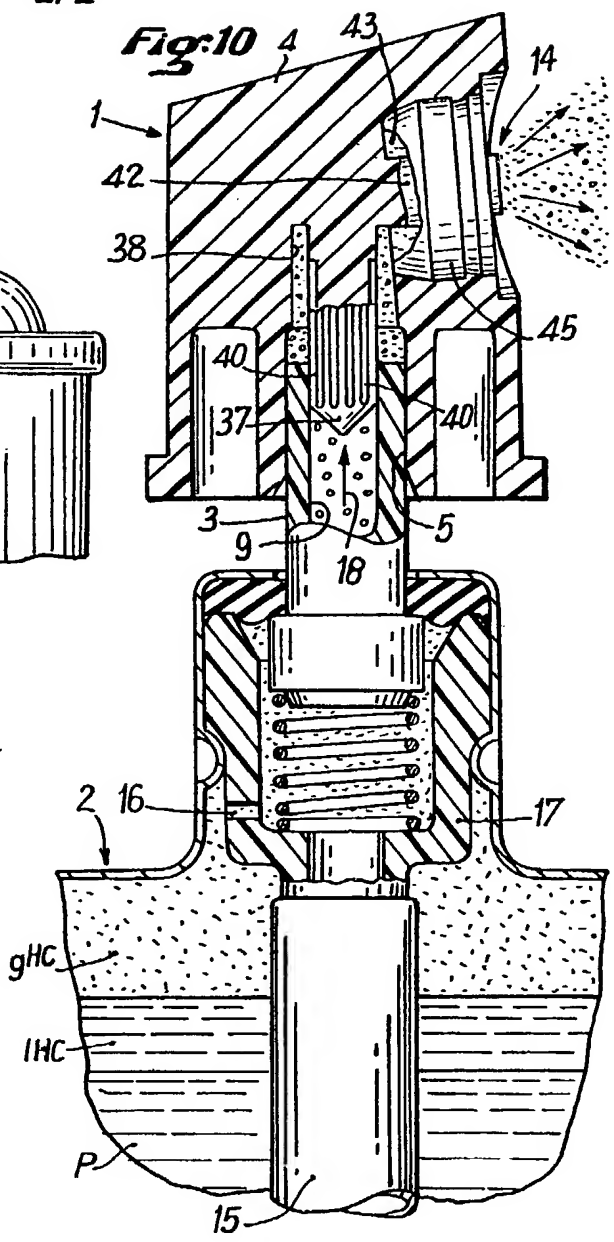


Fig:11

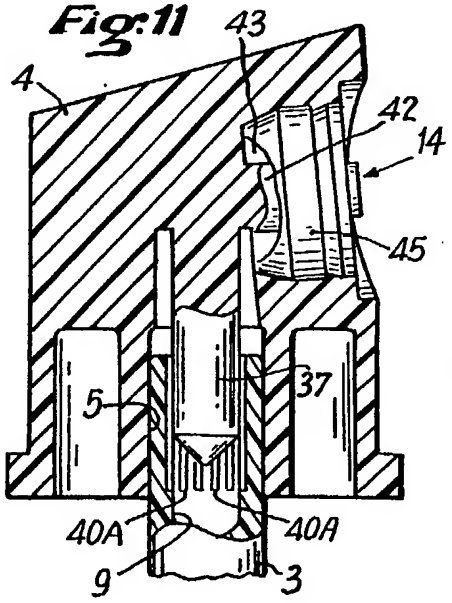


Fig:12

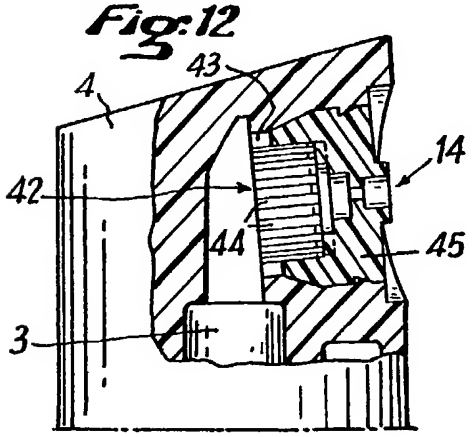
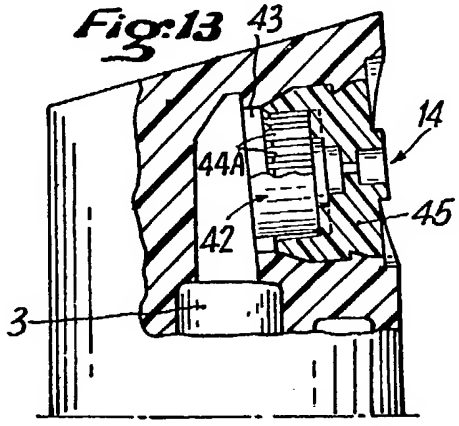


Fig:13



SPECIFICATION

Aerosol valve with improved vapor mixing

This invention relates to an aerosol valve and more particulary to a valve capable of use with three-phase products such as a hydrocarbon propellant with aqueous product, or aqueous alcoholic blended products, yet having the superior spray characteristics of previously used fluorocarbon propellant systems.

With the recent furor by environmentalists that fluorocarbon propellants are damaging the atmosphere, the trade has reexamined the use of old and less favored hydrocarbon propellants. Butane, isobutane, propane and blends of these are typical.

Hydrocarbons, per se, are generally flammable. They also do not mix well or remain mixed with the product being dispensed, espetially if water-based. Thus, poor mechanical breakup of the product occurs. To overcome such, vapor taps (hole 16) have been used but such an approach requires excessive and wasteful quantities of hydrocarbon and do not always produce the desired non-flammability properties in conjunction with adequate spray properties.

When used with water-based products, the flammability of hydrocarbon may be overcome. However, the mechanical breakup problem persists.

Hydrocarbons, as propellants, exhibit dry spray characteristics when used with products that are miscible with the hydrocarbon. Normally, dry spays are desirable for use with products coming into contact with the human body, such as hair sprays. Therefore, even though hydrocarbons are not as desirable as fluorocarbon as an all-purpose propellant, they have been used for their dry spray attribute. Unfortunately, the mechanical breakup problem of hydrocarbons plague the aerosol filler, especially when used with aqueous products with which the hydrocarbon is not miscible.

Recently, an aspirator-type valve has been introduced claiming enhancement of the use of hydrocarbon propellants. Two separate passageways joining just behind the terminal orifice is involved. Unfortunately, such structure is complicated and is difficult to mold with any accuracy. In addition, a totally new valve body, valve stem and valve button structure must be manufactured. Expensive revamping of manufacturing, assembly and filling procedures is accordingly necessitated. Obviously, such is undesirable just from a cost standpoint alone.

Therefore, it is an object of this invention to provide a new aerosol valve which overcomes the aforementioned inadequacies of the prior art and provides an improvement which is a significant contribution to the advancement of the pertinent art.

Another object is to provide a new aerosol valve structure.

Still another object is to provide a new aerosol valve structure useful for hydrocarbon propellants.

A further object is to provide a new aerosol valve structure sepecially useful for hydrocarbon propellants which is economical to manufacture.

A still further object is to provide a new aerosol valve which is easily adaptable to standard assembly, mounting and pressure filling techniques.

Other objects and a fuller understanding of this invention may be had by referring to the description and the claims, taken in conjunction with the accompanying drawings.

The aerosol valve of this invention has been found to be an excellent hydrocarbon propellant aerosol valve. It is produced by incorporating mechanical homogenizing means in the valve stem cavity, or the button or actuator, such as in the valve stem receiver cavity of said button or actuator or the cavity just behind the terminal orifice. The homogenizer may consist of a porous substance, such as open cell foam plastic taking the shape of individual balls or as a slug or a plastic mesh screen, or a wad of cotton. More particularly, when a plurality of balls of open cell foam plastic, or a slug of such open cell form plastic, or a wad of fibrous material having the dimensions of the cavity, are inserted into the cavity, or when plastic mesh screen is affixed to the top of the hollow valve stem, or inserted into the valve stem receiver cavity or the terminal orifice cavity of the button or actuator, the homogenizer structure uniquely homogenizes the hydrocarbon and the product just before it is emitted. The homogenizer may also consist of a micronized multi-grooved homogenizer tappet which extends into the cavity of the hollow valve stem, or into the terminal orifice cavity of the button or actuator. The micronized multi-grooved tappet uniquely homogenizes the hydrocarbon and the product just before it is emitted. Thus, mechanical breakup of the product occurs as it is emitted. If balls of open cell foam plastic are utilized, and if they have a diameter slightly similar to the dimension of the valve stem cavity, they need merely be rolled into the cavity. If in the form of a slug or wad, the homogenizer need merely be pushed into the cavity. Alternatively, the homogenizer may be inserted into the valve stem receiver cavity or the terminal orifice cavity of the button or actuator. A plastic mesh screen of appropriate mesh size to act as homogenizer and even as a filter, affixed, such as by welding, to the top of the valve stem over its cavity, or inserted as a washer into the valve stem receiver cavity of the button or actuator and secured on top of the valve stem provides similar results. If a terminal orifice insert type button is used, the homogenizer material can be used behind the

terminal orifice insert. Thus a most efficient to manufacture and to use valve, without custom redesigning, is provided.

The invention accordingly comprises an article of manufacture possessing the features, properties and the relation of elements which will be exemplified in the article hereinafter described, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

Figure 1 is a front view of the valve of this invention mounted within an aerosol can;

Figure 2 is a cross-sectional view of the valve and the aerosol can taken along line 2–2 of Fig. 1;

Figure 3 is a cross-sectional view of another embodiment of the homogenizer;

Figure 4 is a cross-sectional view of still another embodiment of the homogenizer;

Figure 5 is a cross-sectional view of another embodiment of the homogenizer;

Figure 6 is a cross-sectional view of another embodiment of the homogenizer;

Figure 7 is a cross-sectional view of the button of Fig. 2 but modified to contain a homogenizer of this invention;

Figure 8 is a similar cross-sectional view of the button of Fig. 1 modified to contain another homogenizer of this invention;

Figure 9 is a front view of the valve according to another embodiment of this invention, mounted within an aerosol can;

Figure 10 is a cross-sectional view of the valve and the aerosol can taken along line 10–10 of Fig. 9;

Figure 11 is a cross-sectional view of another embodiment of the homogenizer;

Figure 12 is a cross-sectional view of still another embodiment of the homogenizer; and

Figure 13 is a cross-sectional view of still another embodiment of the homogenizer.

As seen in Figs. 1 and 9, the valve 1 of this invention is mounted within aerosol can 2 in the customary manner using a mounting cup. In appearance the valve is like other valves that are currently on the market. The interior of the valve however, is new. It is best explained with a first example by reference to Figs. 2 to 6.

Referring to Fig. 2, the valve has the customary hollow valve stem 3 and button 4. Alternatively, the button 4 could be replaced by an actuator (not shown). It should also be understood that the valve of this invention may have an integral valve stem-button or actuator configuration. In such construction, the valve stem is removable from the valve (not shown) as compared to removability of the button from the valve stem.

The upwardly extending exposed portion of the hollow valve stem 3 has the button 4 mounted thereon. The valve stem fits within the valve stem receiver cavity 5 of the button.

In the embodiment shown in Fig. 2, there is a slug 6 of open cell foam plastic spaced between the top of the hollow valve stem 3 and the ceiling of the cavity 5 in button 4. As will be explained below, the slug 6 acts as an homogenizer of the gaseous propellant and the product as both are dispensed from the aerosol can.

In the embodiment shown in Fig. 3, the homogenizer takes the shape of a plastic mesh screen 7 which has been welded, such as by sonic welding, to the upper end of the valve stem 3. Alternatively the screen 7 could be welded to the ceiling of the receiver cavity 5. It may also be loosely secured therein. The edges of passageway 13 of the button may be filleted as shown for more efficient passage of intermixed product and propellant through the button.

In Fig. 4, the homogenizer takes the shape of a wad 8 of cotton, or wool, or rayon, or nylon, or similar fibrous material inserted into the cavity 9 of the valve stem 5.

In Fig. 5, the homogenizer takes the shape of a plurality of balls 10 of open cell foam plastic or similar porous material, inserted into the cavity 9 of the valve stem 5.

In Fig. 6, the homogenizer takes the shape of a rod 11 of one cell foam plastic or similar porous material inserted and located within the cavity 9 of the valve stem 5.

In Fig. 7 the homogenizer comprises a wad 21 of cotton, or wool or rayon or nylon, or similar fibrous material inserted into the cavity 22 of the terminal orifice insert 23 prior to assembly. Anchoring ring 24 holds the insert 23 within the valve button 4.

In Fig. 8, the homogenizer takes the shape of a rod 25 of open cell foam plastic or similar porous material inserted and located within the cavity 22 of the terminal orifice insert 23.

It should be evident that a plastic mesh screen as in the embodiments of Fig. 3 could also be used. The balls of Fig. 5 are not as convenient, but they could feasibly be similarly used.

If desired, the terminal orifice insert 23 could also be of mechanical breakup type to further aid in homogenization and in breakup of the sprayed product.

In the embodiment shown in Figs. 4, 5, 6, 7 and 8, the outer dimensions of the wad, balls or rod approximates the inner dimension of the cavity whereby no bypass leakage occurs around the homogenizer.

Referring to Fig. 10, the valve has the customary hollow valve stem 3 and button 4. in the embodiment shown in Fig. 10, the homogenizer of this invention takes the form of a tappet 37 extending downwardly from the ceiling of the cavity 38 in button 4. Its outer dimension is adjusted for a good fit

within the cavity 9 of the hollow valve stem. Its surface contains a multiplicity of micronized grooves 40. These grooves, when inserted in the hollow valve stem, act as passageways for product and propellant emitted out of the aerosol can 2 when the valve 1 is opened. The grooves 40, by reason of their micronized size and by their multiplicity, act to homogenize the product and propellant during emission. A uniquely fine dispersion results and the spray effected thereby duplicates the fine mechanical breakup action seen heretofore.

If desired, the bottom edge of tappet 37 may be filletted as shown for more efficient assembly.

In Fig. 11, the homogenizer takes the form of a multiplicity of grooves 40A in the wall of the cavity 9 of the valve stem 3. The tappet 37 that is utilized therewith has a smooth surface, whereby when inserted into the hollow valve stem, a multiplicity of passageways are formed which act as a homogenizer of the product and the propellant.

In Fig. 12. the homogenizer takes the form of a post 42 within the button. Post 42 extends into the terminal orifice insert cavity 43. The outer surface of the post contains a multiplicity of micronized grooves 44. Alternatively, the inside surface of the insert 45 may contain the multiplicity of micronized grooves 44A with the post smooth (see Fig. 13).

The outer dimension of the post is adjusted to a dimension approximately the inside dimension of the terminal orifice insert for a good fit within the cavity of the terminal orifice insert whereby a multiplicity of passageways will be formed when assembled. As above, these act to homogenize the product and propellant during emission.

Now in operation, the above described embodiments of homogenizer act, when the valve is opened, to thoroughly homogenize product and gaseous propellant that is emitted. More specifically, and with reference to Figs. 2 and 10, the customary layering of product, liquid phase hydrocarbon propellant, lHC, and vapor or gaseous phase hydrocarbon propellant, gHC, in ascending order, within the aerosol can 2 occurs. Upon opening of the valve by tilting or pressing button 4 downwardly, product P and gaseous propellant gHC is thereby caused to flow upwardly out of the aerosol can 2 through the dip tube 15 and through vapor tap 16 in the wall of the valve body 17, respectively. Then the flow of both product and gaseous HC, in a poorly mixed state, continues upwardly through the valve stem 3 in the direction of arrow 12 (Fig. 2) or 18 (Fig. 10). In this zone, the product, as well as the gaseous propellant, will probably mostly be in discrete zones of liquid and gas bubbles, especially if the product and propellant are incompatible. Upon reaching homogenizer 6, 37, there is a buildup of product and propellant caused by the restriction of the open cell foam plastic there shown or by the restriction of the micronized passageways. The propellant forces the product through the plastic or the passageways. In so doing it intimately intermixes with the product in the form of extremely minute bubbles of gas. Such causes the product and propellant to homogenize in a unique complete blending action. Obviously, the more minute the bubbles, the better the homogenization.

Thereafter, the highly homogenized product and propellant emit through the terminal orifice passage 13 extending from the slug 6 to the terminal orifice 14 of the button 4. If a terminal orifice insert of the mechanical breakup type is utilized further homogenization may occur prior to terminal emission.

In similar fashion, the plastic mesh screen 7 of Fig. 3 or the wad of cotton 8 in Fig. 4 or the plastic balls 10 of Fig. 5 or the rod 11 of plastic of Fig. 6 also act to homogenize the products and gaseous propellant.

As shown in the figures of the drawing, it is essential that the homogenizer utilized be located close to the terminal orifice. Otherwise, and especially if the product and propellant are highly incompatible, the product and propellant will resort to their original non-mixed state. It has been found that the best location for the homogenizer is anywhere close to the terminal orifice, such as shown in Figs. 2 and 7.

It should be evident that the valve of this invention with its homogenizer structure causes better homogenization of the product and gaseous propellant bubbles so that upon emission from the terminal orifice, better breakup occurs of the product.

The present disclosure includes that contained in the appended claims, as well as that of the foregoing description. Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and scope of the invention.

Now that the invention has been described:

CLAIMS

1. An aerosol valve especially suitable for hydrocarbon propellants, having a valve stem and valve actuator means, the improvement comprising an homogenizer including a great number of very narrow passages, located neat the terminal orifice of said valve.

2. The valve of claim 1 wherein said homogenizer comprises a porous material.

3. The valve of claim 2 wherein said homogenizer comprises a wad of porous plastic material spaced between the top of the valve

stem and the ceiling of the valve stem receiver cavity of the valve actuator means.

4. The valve of claim 2 wherein said homogenizer comprises a plastic mesh screen secured between the top of the valve stem and the ceiling of the valve stem receiver cavity of the valve actuator means.

5. The valve of claim 2 wherein said homogenizer comprises a wad of fibrous material located within the cavity of the valve stem.

6. The valve of claim 2 wherein said homogenizer comprises a plurality of balls of porous material, located within the cavity of the valve stem, the dimension of the balls approximating the dimension of said cavity.

7. The valve of claim 2 wherein said homogenizer comprises a slug of porous material, located within the cavity of the valve stem, the dimension of the slug approximating the dimension of said cavity.

8. The valve of claim 2 wherein said valve actuator means includes a terminal orifice insert and said homogenizer comprises a wad of fibrous material located within the cavity of said insert.

9. The valve of claim 2 wherein said valve actuator means includes a terminal orifice insert and said homogenizer comprises a slug of porous material located within the cavity of said insert.

10. The valve of claim 1 wherein said homogenizer comprises micoronized passages.

11. The valve of claim 10 wherein said homogenizer comprises a tappet extending downwardly from the ceiling of the valve stem receiver cavity of said valve actuator means, the outer dimension of the tappet approximating the inner dimension of the cavity of the valve stem, having a good fit therewith and the surface of the outer dimension having a multiplicity of micronized grooves in its surface.

12. The valve of claim 10 wherein said homogeniser comprises a tappet extending downwardly from the ceiling of the valve stem receiver cavity of the valve actuator means, the outer dimension of the tappet approximating the inner dimension of the cavity of the valve stem having a good fit therewith, and the mating surface of said cavity of said valve stem having a multiplicity of micronized grooves therein.

13. The valve of claim 10 wherein said homogenizer comprises a post in a cavity of the terminal orifice insert of said valve actuator means, the dimension of the post approximating the inner dimension of the cavity of said insert and having a good fit therewith, a multiplicity of micronized grooves being provided in the surface of the post.

14. The valve of claim 10 wherein said homogenizer comprises a post in a cavity of the terminal orifice insert of said valve actuator means, the dimension of the post approximating the inner dimension of the cavity of said insert, and having a good fit therewith, a multiplicity of micronized grooves being provided in the surface of the cavity.

15. An aerosol valve, substantially as hereinbefore described with reference to any of the embodiments shown in the accompanying drawings.

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